



# From obesity to inflammation: emerging frontiers in prostate cancer and metabolic syndrome studies

Xi Xu<sup>1,2#</sup>, Jinshan Xu<sup>1#</sup>, Hongliang Gao<sup>1#</sup>, Zhaoyang Sheng<sup>1</sup>, Yang Xu<sup>1</sup>, Shuxiong Zeng<sup>1</sup>, Guanghua Chen<sup>1</sup>, Zhensheng Zhang<sup>1^</sup>

<sup>1</sup>Department of Urology, First Affiliated Hospital, Naval Medical University, Shanghai, China; <sup>2</sup>Department of Support, Unit 31635 of Chinese People's Liberation Army, Guilin, China

**Contributions:** (I) Conception and design: S Zeng, G Chen, Z Zhang; (II) Administrative support: Z Zhang; (III) Provision of study materials or patients: X Xu, J Xu, H Gao; (IV) Collection and assembly of data: X Xu, J Xu, H Gao; (V) Data analysis and interpretation: X Xu, J Xu, H Gao; (VI) Manuscript writing: All authors; (VII) Final approval of manuscript: All authors.

<sup>#</sup>These authors contributed equally to this work as co-first authors.

**Correspondence to:** Shuxiong Zeng, MD; Guanghua Chen, MD; Zhensheng Zhang, MD. Department of Urology, First Affiliated Hospital, Naval Medical University, No. 168 Changhai Road, Yangpu District, Shanghai 200433, China. Email: zengshuxiong@126.com; hxcgh@163.com; zhangzssmmu@163.com.

**Background:** According to recent studies, prostate cancer (PCa) is strongly associated with metabolic syndrome (MetS). However, there has not been any bibliometric visual analysis of relevant papers. In order to acquire knowledge about research settings and possible future paths, a thorough bibliometric study of MetS-related PCa research was carried out.

**Methods:** From January 1, 2004 to December 31, 2023, original and review publications about MetS and PCa were retrieved from the Web of Science Core Collection (WOSCC) database. Analysis of co-authorship and co-occurrence was done using VOSviewer. To find the top terms with the greatest citation burst, CiteSpace was used.

**Results:** There were 1,296 publications on PCa and MetS in all. The analysis showed that the number of yearly scientific papers in the sector was on the rise. The three most productive nations were China, Italy, and the USA. Most papers were published in the *PLoS One*, while most citations were obtained by the *European Urology*. The most influential author in terms of citations was Professor Smith MR, whereas the most prolific author was Professor Freedland SJ. Keyword analysis revealed that, apart from PCa and MetS, “obesity” was the most often used phrase, with “risk”, “meta-analysis”, and “inflammation” appearing as study subjects. Furthermore, “components” and “sex hormones” gained more and more attention.

**Conclusions:** The findings provide a thorough understanding of the larger context of this field of study. Future studies need to investigate PCa's metabolic processes and inflammatory mechanism. Furthermore, switching from observational research to meta-analysis offers the possibility of illness prediction and tailored therapies. These results may help researchers navigate the most recent advancements and influence the field's future paths.

**Keywords:** Prostate cancer (PCa); metabolic syndrome (MetS); bibliometric; obesity; inflammation

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<sup>^</sup> ORCID: Xi Xu, 0009-0004-2567-616X; Zhensheng Zhang, 0009-0007-3617-9515.

## Introduction

### Background

The second most prevalent disease diagnosed globally is prostate cancer (PCa) (1). There are regional differences in the occurrence of PCa, with larger rates seen in the USA and Europe than in Asia (2). China has shown an increase in PCa incidence in recent years (3). Up to 80% of males over 80 years old have PCa cells, and the disease's incidence rises with age (4). In addition to age, the metabolic syndrome (MetS) also increased the risk of PCa (5).

### Rationale and knowledge gap

Changes in hormones and metabolism that may impact cancer biology are part of MetS, which is defined by insulin resistance with hypertension, excess body weight with central obesity, and dyslipidemia (6). The earliest evidence of a link between MetS and PCa risk was found in 2004 (7). Since then, a number of investigations have shown that MetS negatively affects PCa incidence and prognosis (8). At the same time, some research suggested that MetS could promote the development of PCa (9). However, other research found a negative correlation and no relationship between MetS and PCa (10). A thorough and understandable examination of the present research frontiers and hotspots in the fields of MetS and PCa is lacking, nevertheless.

### Highlight box

#### Key findings

- Bibliometric analysis of prostate cancer (PCa) and metabolic syndrome (MetS) research from 2004–2023 shows increasing publications, with the USA, Italy, and China leading research.
- Key research trends include “obesity”, “risk”, “meta-analysis”, and “inflammation” as critical domains.

#### What is known and what is new?

- Inconsistent relationships between MetS and PCa risk in previous studies.
- First systematic bibliometric analysis providing insights into research trends and potential future directions.

#### What is the implication, and what should change now?

- Emphasizes interdisciplinary collaboration on metabolic processes and inflammatory mechanisms in PCa.
- Recommends transitioning from observational studies to meta-analyses for improved disease prediction and personalized treatments.

### Objective

Bibliometric analysis standardizes the extraction of key publication data such as research topics, authors, and countries (11). By counting citations, bibliometric analysis may reveal an article's academic impact. Researchers may also analyse term co-occurrence to identify study domain trends and established areas of interest (12,13). This study examines PCa and MetS research using bibliometric analysis, including performance assessments and scientific mapping. The report analyzes significant research topics, performance patterns, and new frontiers to suggest future research orientations.

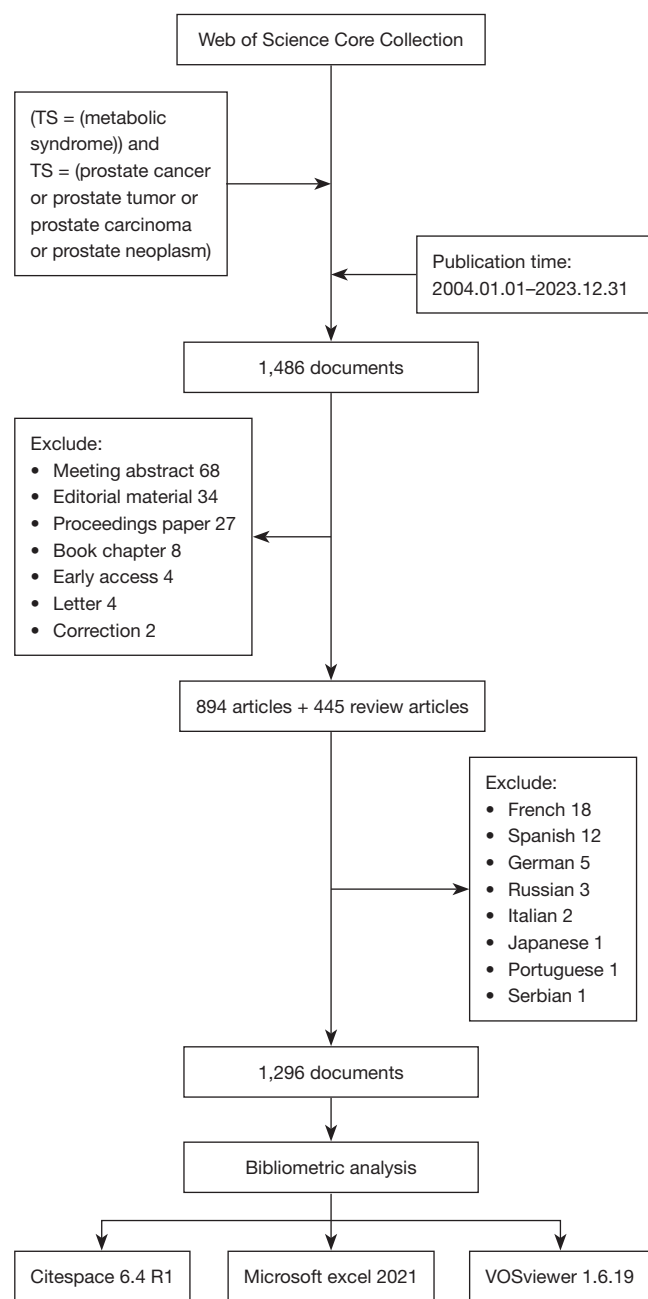
## Methods

### Data source and retrieval strategy

The Web of Science Core Collection (WOSCC) database was collected on October 20, 2024. Thomson & Reuters Corporation's WOS is one of the most commonly used academic databases, providing numerous prominent journals and complete information about publications worldwide (14). We searched the WOS for PCa/MetS trials. The retrieval words were searched using (TS = (metabolic syndrome)) AND TS = (prostate cancer OR prostate tumor OR prostate carcinoma OR prostate neoplasm). Literature was limited to “English”, “articles” and “review articles” published between 1 January, 2004 and 31 December, 2023. Two writers (X.X. and J.X.) independently selected 2004–2023 publications to assure findings dependability. Two writers discussed procedure discrepancies until they agreed. A third author (H.G.) arbitrated if needed. No ethical clearance was sought for the bibliometric research. Final list was exported to Excel 2021, VOSviewer, and CiteSpace for analysis. Finally, *Figure 1* depicts literature screening.

### Visualized analysis

VOSviewer is a visual application used for scientific mapping analysis of journal papers because to its sophisticated user interface and mapping visual capacity (15). In particular, VOSviewer (1.6.18) extracted high-frequency data including nations, institutions, and keywords. VOSviewer simplifies bibliometric analysis by visually representing them. We discover a study field trend and create a network map for visual examination. Drexel University scholar Chaomei Chen created CiteSpace software. The app visualizes scientific references using Java. CiteSpace is a popular bibliometric application for topic evolution and burst



**Figure 1** Flow chart of the literature search.

detection (16). CiteSpace 6.4.R1 detected keyword bursts in this investigation. Over time, bursts are noted often.

## Results

### Annual publications trend

MetS and PCa study literature has increased steadily, as

seen in *Figure 2*. Three periods can be distinguished in the history by looking at annual publishing numbers: 2004–2006, 2007–2016, and 2017–2023. The discipline was still in its infancy on Period I, with averaging of 7.3 publications published annually. Period II had 67.8 articles published yearly, indicating a significant increase in research. Period III produced 85.1 publications each year, a significant increase in research production. In Period III, publications on MetS-PCa interactions increased significantly during the previous 5 years, indicating an increasing interest and research environment.

### Countries or regions

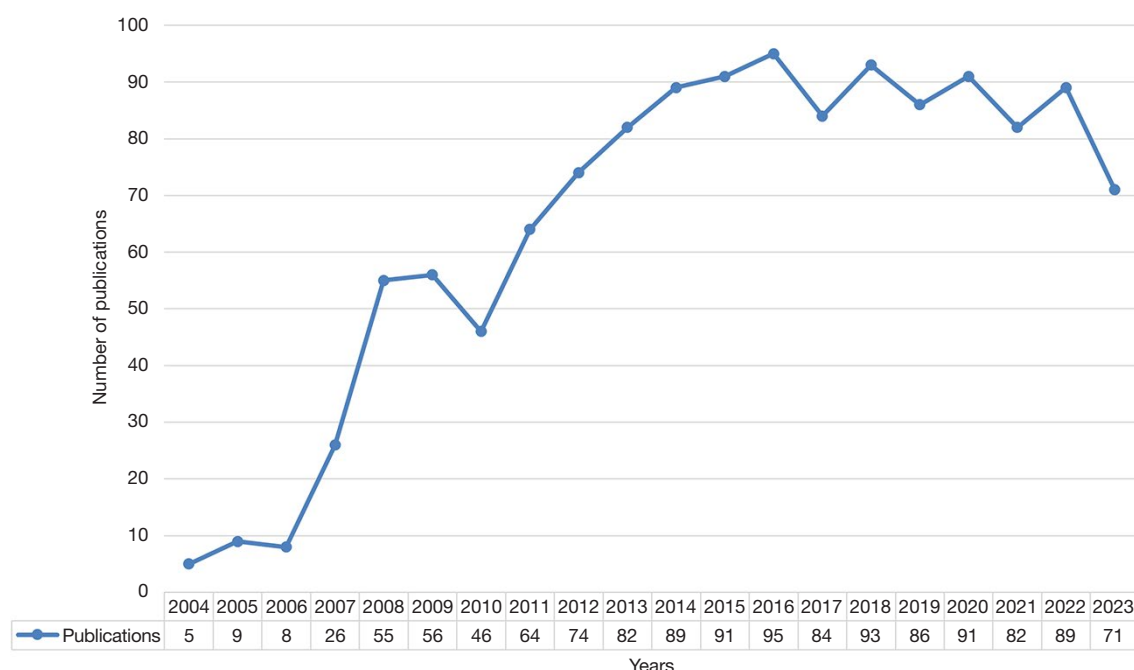
*Figure 3A* shows that the top 10 countries/regions were on four continents, four in Europe and three in Asia. The USA published 466 publications, followed by Italy with 147, China with 140, and England with 108. The USA leads in published citations with over 28,000. *Figure 3B* shows a collaborative network map created by emphasizing countries with 10 or more publications. This network depicts countries or regions by node size, which matches publication volume. The network in *Figure 3B* showed that the USA, Italy, England, and Canada were crucial to PCa and MetS research interactions. Since 2018, Chinese studies have appeared, showing increasing PCa and MetS research in China.

### Institutes

A detailed analysis found that 1,904 institutions contributed to this domain's intellectual debate. According to *Figure 4A*, five of the top 10 universities by publishing volume were from the USA, with the others from England, Canada, Sweden, and Italy. Harvard University has the most publications ( $n=30$ ) and citations ( $n=4,180$ ) in this category. This emphasizes its importance in PCa and MetS studies. *Figure 4B* shows institutions' collaborative partnerships, with node size matching to publication output. Harvard University collaborated with almost every reputable scientific institution on robotic cystectomy research in the previous decade. Fudan University and King's College London are light-colored nodes, suggesting burgeoning research institutes.

### Journal and co-cited journal

The 1,296 articles included in this evaluation were published in 566 different publications. The top 10 journals



**Figure 2** Annual number of publications from 2004 to 2023.

by number of publications are shown in *Table 1*, with *PLoS One* coming in first with 32 papers, followed by the *Prostate Cancer and Prostatic Diseases* with 27 papers, and the *Prostate* with 23 papers. However, concerning the number of citations, *European Urology* was the most cited journal, followed by *PLoS One* and *Cancer Epidemiology Biomarkers & Prevention*, with 4,599, 1,308, and 841 citations, respectively. Seventy percent of the above magazines are in the journal citation reports (JCR) Q1 of the areas they specialize in, and their mean score for impact is 5.64.

The top 10 publications by the number of supplementary citations are also included in *Table 1*. With 3,228 citations, the *Journal of Clinical Endocrinology & Metabolism* is the highest co-cited journal, followed by the *Journal of Urology* (1,719 citations), the *Journal of Clinical Oncology* (1,591 citations), and *European Urology* (1,538 citations), all of which have more than 1,500 supplementary citations. Nine of these prestigious journals are Q1 major magazines. With the greatest impact factor of 96.2, *The New England Journal of Medicine* stands out as having a major effect on the field of medicine.

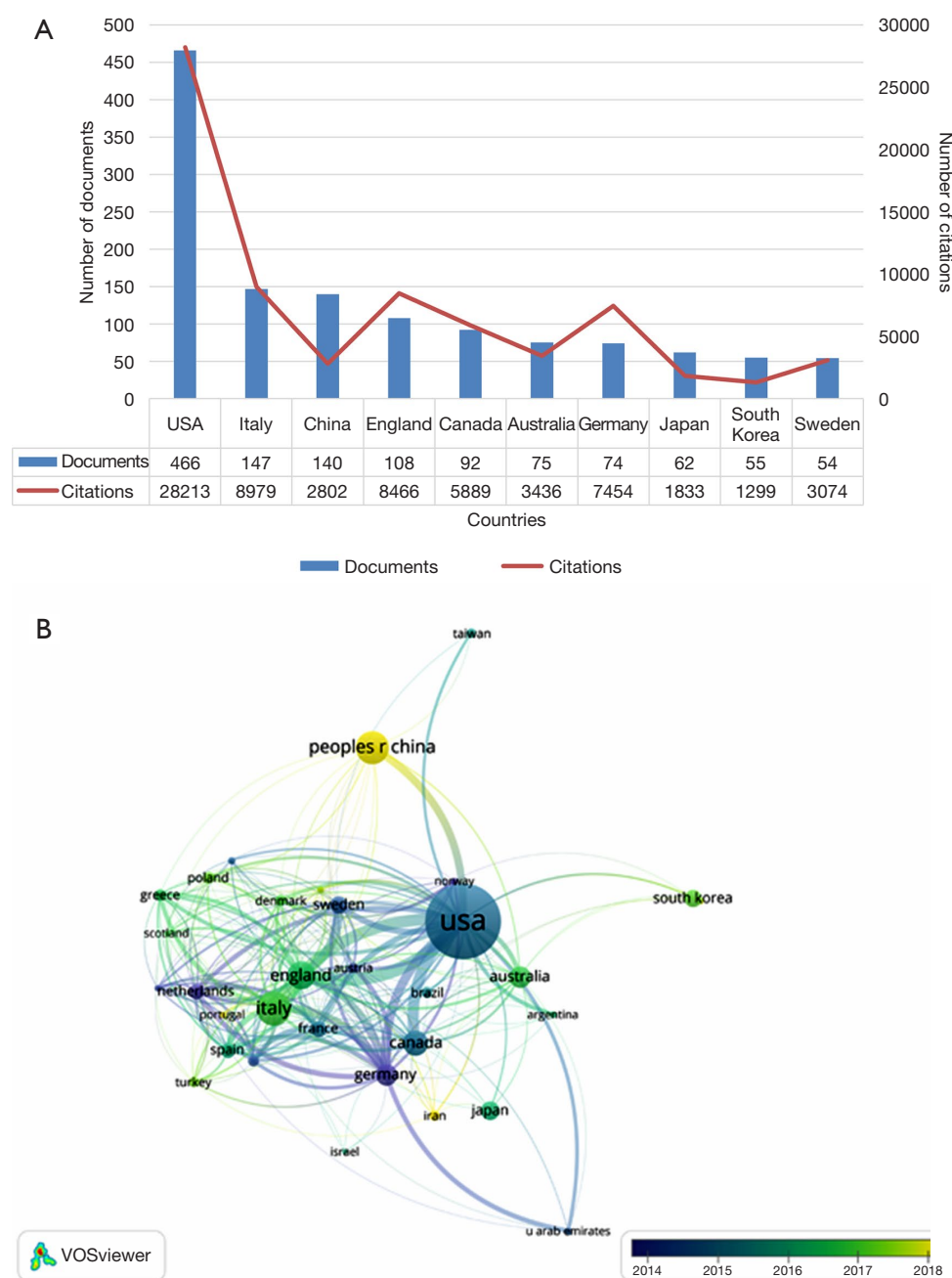
#### Authors and co-cited authors

The top ten writers who have made noteworthy

contributions to the study of PCa and MetS are highlighted in *Table 2*. These people, who were often connected to the same research facility, became important players in the area. With 22, 17, and 17 papers published, respectively, Freedland SJ, van Hemelrijck Mieke, and Maggi Mario were the top three writers among them. Nonetheless, Smith MR was the author with the most impact in terms of citations. Interestingly, just one author on this top 10 list was from Asia, while 30% of the writers were from Kings Coll London, England. The top 3 most often co-cited authors were Smith MR, Corona G, and Hsing AW, as seen in *Table 2* as well, underscoring their significant influence and effect in this field of study.

#### Documents and references

*Table 3* shows the top 10 high-citation documents from document citation analysis (17-26). The top 10 articles have 1,128 to 516 citations. JCR Q1 published 70% of these publications, JCR Q2 20%. Interestingly, nine of these 10 studies reviewed PCa and MetS recommendations. The *British Medical Journal* article “Coffee consumption and health: umbrella review of meta-analyses of multiple health outcomes” (26) has the greatest impact factor. The most referenced paper was a

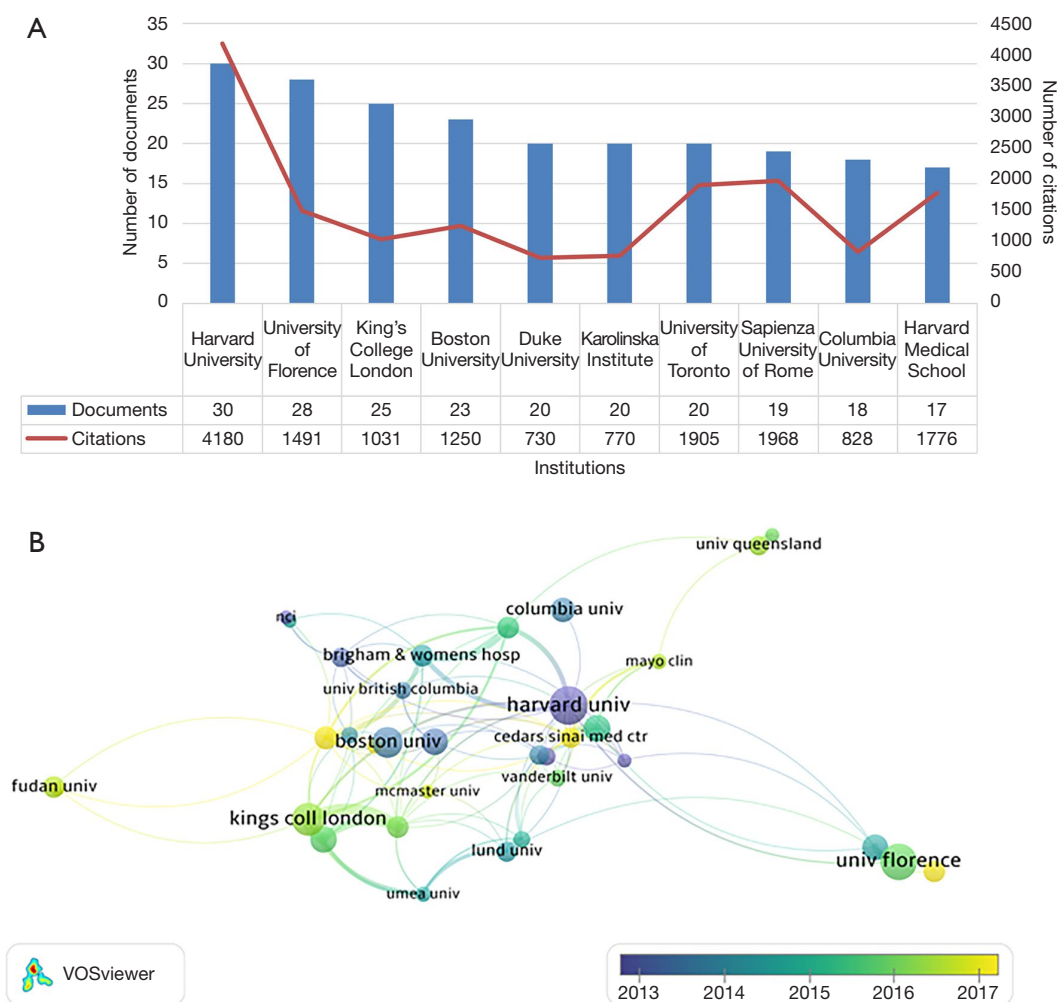


**Figure 3** Analysis of countries or regions on prostate cancer and metabolic syndrome research. (A) Documents and citations of the top 10 most productive countries or regions. (B) Time-overlapping network.

clinical guideline on PCa released in 2017 on the *European Urology*, which offered practical information and evidence for researchers and practitioners (17).

Numerous articles mention co-cited references, which underlie certain study topics. PCa and MetS research has advanced significantly in the last two decades. *Table 4* lists

the top 10 high-cited references (27-35). All references are from high-quality JCR Q1 journals. *The New England Journal of Medicine* article “Overweight, obesity, and mortality from cancer in a prospectively studied cohort of U.S. adults” (34) has the greatest impact factor. “Metabolic syndrome in men with prostate cancer undergoing long-



**Figure 4** Analysis of institutions on prostate cancer and metabolic syndrome research. (A) Documents and citations of the top 10 most productive institutions. (B) Time-overlapping network.

term androgen-deprivation therapy” (27) was the most referenced and published *Journal of Clinical Oncology* article.

### Keywords

Keyword occurrence analysis helps identify field research patterns quickly. The 20 most common terms were shown in *Figure 5A*. Apart from PCa and MetS, “obesity” (289 occurrences), “risk” (267 occurrences), “men” (238 occurrences), and “insulin-resistance” (208 occurrences) were the top keywords.

*Figure 5B* shows a keyword overlay with a color gradient from dark blue to bright yellow showing sequential keyword introductions. Early studies emphasized “insulin-resistance”, “body-mass index”, “middle-aged men”, “body-

composition”, and “erectile dysfunction”. In contrast, modern research has focused on “risk”, “meta-analysis”, “inflammation”, and “oxidative stress”, indicating new research hotspots and topic approaches.

Keyword clustering analyzes the distribution and relationships in a field. Research importance increases with a lower cluster number and a larger corpus of literature. As shown in *Figure 5C*, these clustering results assisted in classifying recent study tendencies and emphasis areas into three primary domains: (I) common pathological processes (clusters #0, #1, #2, #6, #10, #11, and #12); (II) treatments and preventive strategies (clusters #3, #4, and #7); and (III) risk factors (clusters #5, #8, #9).

Keyword burst analysis may uncover transient spikes in keyword frequency, indicating a common interest among



**Table 1** The top 10 journals and co-cited journals involved in prostate cancer and metabolic syndrome research

Ranks	Journal					Co-cited journal			
	Name	Documents	Citations	IF [2023]	JCR	Name	Citations	IF [2023]	JCR
1	<i>PLoS One</i>	32	1,308	2.9	Q1	<i>Journal of Clinical Endocrinology &amp; Metabolism</i>	3,228	5	Q1
2	<i>Prostate Cancer and Prostatic Diseases</i>	27	827	5.1	Q1	<i>Journal of Urology</i>	1,719	5.9	Q1
3	<i>Prostate</i>	23	791	2.6	Q2	<i>Journal of Clinical Oncology</i>	1,591	42.1	Q1
4	<i>BJU International</i>	22	703	3.7	Q1	<i>European Urology</i>	1,538	25.3	Q1
5	<i>Aging Male</i>	20	703	2.7	Q2	<i>Cancer Epidemiology Biomarkers &amp; Prevention</i>	1,497	3.7	Q1
6	<i>Urologic Oncology-Seminars and Original Investigations</i>	18	457	2.4	Q2	<i>New England Journal of Medicine</i>	1,329	96.2	Q1
7	<i>European Urology</i>	16	4,599	25.3	Q1	<i>Cancer Research</i>	1,207	12.5	Q1
8	<i>Asian Journal of Andrology</i>	15	261	3	Q1	<i>Diabetes Care</i>	1,141	14.8	Q1
9	<i>Cancer Epidemiology Biomarkers &amp; Prevention</i>	15	841	3.7	Q1	<i>Urology</i>	1,100	2.1	Q2
10	<i>Oncotarget</i>	14	375	5	Q1	<i>JAMA-Oncology</i>	1,074	22.5	Q1

IF, impact factor; JCR, journal citation reports.

**Table 2** The top 10 authors and co-cited authors involved in prostate cancer and metabolic syndrome research

Ranks	Authors					Co-cited authors	
	Name	Documents	Citations	Institutes	Countries	Name	Citations
1	Freedland SJ	22	1,320	Duke Univ	USA	Smith MR	456
2	van Hemelrijck M	17	645	Kings Coll London	England	Corona G	360
3	Maggi M	17	543	Univ Florence	Italy	Hsing AW	242
4	Stattin P	16	997	Uppsala Univ	Sweden	De Nunzio C	236
5	Tubaro A	16	381	Sapienza Univ	Italy	Hammarsten J	230
6	Garmo H	13	353	Kings Coll London	England	Keating NL	221
7	Holmberg L	13	431	Kings Coll London	England	Freedland SJ	219
8	Saad F	12	866	Gulf Med Coll	United Arab Emirates	Basaria S	214
9	Smith MR	10	1,532	Massachusetts Gen Hosp	USA	Giovannucci E	214
10	Maggi M	10	769	Univ Florence	Italy	Esposito K	188

academics in an area. This method helps track emerging themes and anticipate future research areas. CiteSpace identified 25 terms with noteworthy burst patterns, as seen in *Figure 5D*. In the past, “middle aged men” (2007–2015), “survival” (2018–2023), and “hyperinsulinemia” (2004–2013) received extensive investigation. Also, “hormone

binding globulin” and “endogenous sex hormones” were hotspots, ranking first and second with 13.97 and 6.22 strengths, respectively. However, recent buzzwords like “components” (2021–2023), “meta-analysis” (2021–2023), and “disease” (2019–2023) indicate a movement in PCa and MetS research toward these domains.

**Table 3** The top 10 cited documents involved in prostate cancer and metabolic syndrome research

Ranks	Authors	Citations	Title	Journal	IF [2023]	JCR
1	Cornford 2017	1,128	EAU-ESTRO-SIOG Guidelines on prostate cancer. Part II: Treatment of relapsing, metastatic, and castration-resistant prostate cancer (17)	<i>European Urology</i>	25.3	Q1
2	Altomare 2005	1,110	Perturbations of the AKT signaling pathway in human cancer (18)	<i>Oncogene</i>	6.9	Q1
3	Carracedo 2008	1,103	The PTEN-PI3K pathway: of feedbacks and cross-talks (19)	<i>Oncogene</i>	6.9	Q1
4	Esposito 2012	850	Metabolic syndrome and risk of cancer: A systematic review and meta-analysis (20)	<i>Diabetes Care</i>	14.8	Q1
5	Carracedo 2008	709	Inhibition of mTORC1 leads to MAPK pathway activation through a PI3K-dependent feedback loop in human cancer (21)	<i>The Journal of Clinical Investigation</i>	13.3	Q1
6	Decensi 2010	706	Metformin and cancer risk in diabetic patients: A systematic review and meta-analysis (22)	<i>Cancer Prevention Research</i>	2.9	Q2
7	Forrest 2011	625	Prevalence and correlates of vitamin D deficiency in US adults (23)	<i>Nutrition Research</i>	3.4	Q2
8	Shuster 2012	558	The clinical importance of visceral adiposity: a critical review of methods for visceral adipose tissue analysis (24)	<i>British Journal of Radiology</i>	1.8	Q3
9	Nguyen 2015	538	Adverse effects of androgen deprivation therapy and strategies to mitigate them (25)	<i>European Urology</i>	25.3	Q1
10	Poole 2017	516	Coffee consumption and health: umbrella review of meta-analyses of multiple health outcomes (26)	<i>British Medical Journal</i>	93.6	Q1

IF, impact factor; JCR, journal citation reports.

## Discussion

### General information

Bibliometric approaches were used to analyze PCa and MetS studies from 2004 to 2023. Research production in this area has expanded because to the global focus on MetS, the financial burden of tumors, and the growing knowledge of its causes. Despite appearances, metabolic abnormalities, especially obesity, are linked to PCa formation, progression, and poorer prognosis (36). MetS may cause PCa. However, prior research found conflicting PCa-MetS links (37). Thus, several nations have advanced PCa and MetS research and accelerated its expansion.

The top 10 nations by publication count produced 1,273 articles, 98.2% of the total. The USA, Italy, and China lead the 10 nations in publications. The USA, England, and Germany have the strongest international cooperation. The USA is the most prolific in this subject because to its strong economy, homogeneous diet, and driven researchers.

International cooperation would improve research quality in the area.

Five USA organizations and two North Korean entities are among the top 10 publishers. Most publications are from Harvard, Florence, King's College London, and Boston Universities. They lead PCa and MetS research. Harvard University collaborated with most reputable scientific institutions on robotic cystectomy research. To improve research competitiveness, institutions should form comprehensive collaborations, especially when resources are few.

Analyzing academic publications helps researchers choose relevant journals for submission. Academic publication requires peer-reviewed journals. With 32 articles and 2.9 impact, *PLoS One* had the most. Journals that researched PCa and MetS were mostly ranked beneath 5. Global influence of relevant journals must be increased.

The highly referenced literature indicates that the primary focus of the study is the interaction between PCa



**Table 4** The top 10 cited references involved in prostate cancer and metabolic syndrome research

Ranks	Authors	Citations	Title	Journal	IF [2023]	JCR
1	Braga-Basaria 2006	140	Metabolic syndrome in men with prostate cancer undergoing long-term androgen-deprivation therapy (27)	<i>Journal of Clinical Oncology</i>	42.1	Q1
2	Keating 2006	135	Diabetes and cardiovascular disease during androgen deprivation therapy for prostate cancer (28)	<i>Journal of Clinical Oncology</i>	42.1	Q1
3	Smith 2006	104	Insulin sensitivity during combined androgen blockade for prostate cancer (29)	<i>Journal of Clinical Endocrinology &amp; Metabolism</i>	5	Q1
4	Laukkanen 2004	103	Metabolic syndrome and the risk of prostate cancer in Finnish men: a population-based study (7)	<i>Cancer Epidemiology Biomarkers &amp; Prevention</i>	3.7	Q1
5	Tande 2006	96	The metabolic syndrome is associated with reduced risk of prostate cancer (30)	<i>American Journal of Epidemiology</i>	5	Q1
6	Smith 2002	94	Changes in body composition during androgen deprivation therapy for prostate cancer (31)	<i>Journal of Clinical Endocrinology &amp; Metabolism</i>	5	Q1
7	Lund Håheim 2006	86	Metabolic syndrome predicts prostate cancer in a cohort of middle-aged Norwegian men followed for 27 years (32)	<i>American Journal of Epidemiology</i>	5	Q1
8	Smith 2001	84	The effects of induced hypogonadism on arterial stiffness, body composition, and metabolic parameters in males with prostate cancer (33)	<i>Journal of Clinical Endocrinology &amp; Metabolism</i>	5	Q1
9	Calle 2003	82	Overweight, obesity, and mortality from cancer in a prospectively studied cohort of U.S. adults (34)	<i>New England Journal of Medicine</i>	96.2	Q1
10	De Nunzio 2012	80	The correlation between metabolic syndrome and prostatic diseases (35)	<i>European Urology</i>	25.3	Q1

IF, impact factor; JCR, journal citation reports.

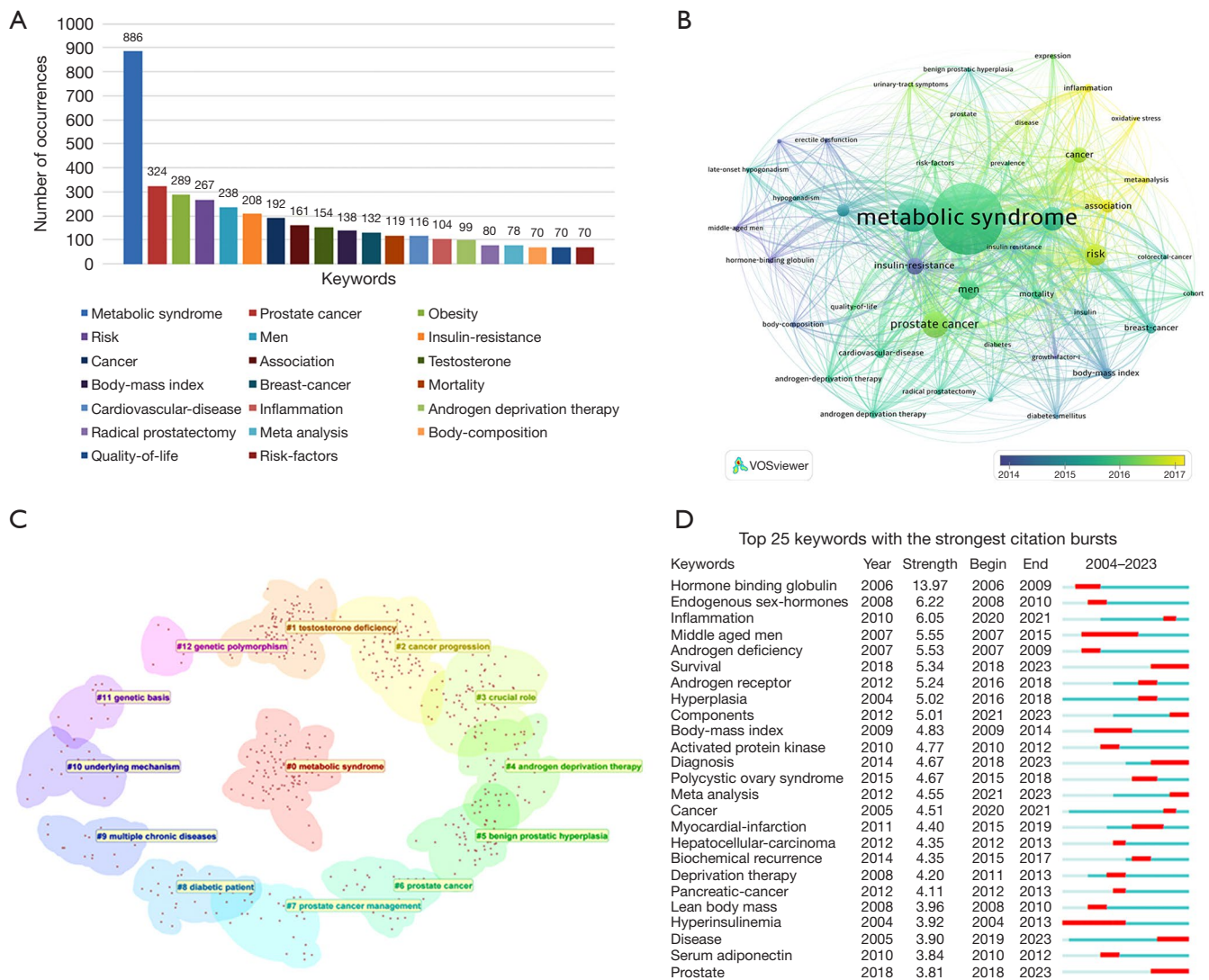
and MetS. Obesity, risk, components, and sex hormones are the most used phrases in this field. Furthermore, a keyword analysis revealed an increasing interest in the mechanism of inflammation and the exploration of meta-analyses in this field.

### Components and risks of MetS

The components of MetS are obesity, diabetes, hypertension, and hypercholesterolemia (38). Increased PCa specific mortality, greater incidence of PCa, and higher rates of biochemical recurrence are all linked to obesity (39). The connections between fat and PC may be explained by biological processes. Increased insulin-like growth factor-1 levels have been associated with obesity and have been demonstrated to boost the risk of PCa (40). According to a case-control study by Hernández-Pérez JG, high blood pressure, lipid alterations, and a notable lifetime rise in body weight were all linked to an increased risk of PCa, as

did MetS (41). Baio *et al.* demonstrate that Italian men with higher BMIs exhibit a significantly elevated risk of PCa, with the relative risk (RR) difference between low and high BMI being most pronounced in younger patients with lower PSA levels and a negative digital rectal examination (42).

Nevertheless, other research points to the opposite outcome. According to a population-based case-control study in Canada, the presence of MetS and PCa incidence are inversely correlated (43). Furthermore, some results suggest that MetS and PCa are independently associated. There was no correlation between MetS and PCa, according to the findings of a case-control research by Lavalette *et al.* (44). The MetS and its components are independent of alcohol and smoking in PCa, according to a Mendelian randomization research, and the authors found no compelling evidence to establish a causal link between the MetS and its components and PCa (45). Therefore, to ascertain whether to prevent MetS and lower the incidence of PCa, further epidemiologic data or meta-analysis are required.



**Figure 5** Visualization of keywords analysis in terms of prostate cancer and metabolic syndrome research. (A) The top 20 keywords in the field. (B) Time-overlapping network. (C) Cluster analysis of keywords. (D) The top 25 keywords with the strongest citation bursts.

### Sex hormones

The androgenic activity of body has an impact on PCa (46). Consequently, the aim of therapy is to either negate the effects of androgens or eliminate them by castration. A common treatment for PCa is androgen deprivation therapy (ADT), which interferes with the processes that produce androgens (47). However, patients with PCa who get ADT have an increased risk of developing MetS, obesity, diabetes, and heart disease (48). One study found that more than half of PCa patients who had undergone ADT for a period exceeding six months had MetS (49). Men with MetS had a shorter time to acquire castration-resistant PCa before

starting ADT than men without MetS (16 *vs.* 36 months, P=0.003).

MetS independently increases the likelihood of testosterone falling to its lowest level for more than 6 months, according to a retrospective research. The elements of MetS and the composite metabolic score have an impact on the levels and timing of testosterone reduction in patients with metastatic PCa. Patients with metastatic PCa have a poorer prognosis the higher their composite metabolic score. Thus, it is critical to take into account the effects of MetS and its constituents while tracking testosterone levels in patients with metastatic PCa and

modify treatment plans appropriately depending on an individual basis (50).

### ***Inflammation mechanism***

A possible connection between metabolic diseases and the risk of PCa has been proposed: chronic inflammation (51). MetS has been finally connected to PCa and is associated with a pro-inflammatory state, which includes elevated levels of C-reactive protein, interleukins-18 (IL-18), IL1 $\beta$ , IL-6, and tumor necrosis factor- $\alpha$  (52). The two primary causes of these connections are inflammation of adipose tissue (AT) and disruption of metabolic homeostasis. While AT enlargement is a response to an imbalance in energy intake and expenditure that promotes energy storage in adipocytes in the shape of fatty acids, hyperinsulinemia produces insulin resistance and the metabolic abnormalities that go along with it (53). The diametric growth of hypertrophied fatty tissue exceeding the level of oxygen absorption potential results in localized hypoxia, especially when sufficient compensatory angiogenesis is not present (54). Therefore, there seems to be a connection between the two conditions, where inflammation may result from an increase in the quantity of fat tissue.

Particularly if the inflammation took place in the fat deposits next to the prostate, it may result in a number of conditions that make PCa more aggressive (55). The inflammation and malfunction of the periprostatic AT, which is located close to the prostate, not only exacerbates the basic neoplastic changes of prostate, it also encourages the development and treatment rejection of PCa (56). Furthermore, hypercoagulable states—conditions that worsen AT inflammation, therefore, fuel PCa onset and advancement—are represented by PCa and the entire range of diseases of metabolism (57).

### ***Meta-analysis***

The RR for obesity and PCa incidence have been found to be positively correlated in three meta-analyses. These RR range from 1.01 [95% confidence interval (CI): 1.0–1.02] per 1 kg/m<sup>2</sup> increase in body mass index (BMI) (58) to 1.05 (95% CI: 1.01–1.08) (59) and 1.03 (95% CI: 1.0–1.07) (60) per 5 kg/m<sup>2</sup> increase. Based on dose-response meta-analyses, obesity also raises the risk of advanced PCa. The risk of advanced disease increases with increases in BMI and waist circumference, with RR 1.08 (95% CI: 1.04–1.12) per 5 kg/m<sup>2</sup> BMI; 1.12 (95% CI: 1.04–1.21) for every 10 cm

increase in waist circumference; 1.15 (95% CI: 1.03–1.28) for every 0.1 unit increase (61).

Furthermore, the link between MetS and PCa is influenced by regional and ethnic characteristics, according to another research. While MetS has little to no effect on PCa risk in the USA and other Asian nations, it increases PCa risk in European countries (62). The impact of multimodal therapies on body composition and MetS in PCa patients treated with ADT was assessed in a comprehensive review with meta-analysis. Overall, the treatments improved the following MetS: diastolic blood pressure: –2.48 mmHg (95% CI: –4.19, –0.76), systolic blood pressure: –3.43 mmHg (95% CI: –6.36, 0.50), and waist circumference: –1.95 cm (95% CI: –3.10, –0.79). Multidisciplinary therapies, particularly those that combine food and nutrition with exercise, may improve metabolic health and body composition in individuals with PCa treated with ADT (63). These meta-analyses also look at the connection between MetS and PCa and preventative measures that researchers and physicians should use.

### ***Limitations***

This research is the first to systematically analyze PCa and MetS using bibliometrics. These results might help researchers uncover possible partners and provide researchers and physicians with useful information. However, it should be noted that this research has a number of intrinsic limitations. First, the literature evaluation was limited to the WOSCC database, which may have led to the omission of pertinent research. Additionally, the selection method could have been biased since the inclusion criteria were limited to English-language publications. Articles published in 2024 were not included since there was not enough data available. Finally, it is important to remember that some freshly released articles could not have received as much attention as more established ones, and as a result, they might get less citations.

### ***Conclusions***

A bibliometric examination of PCa and MetS research shows an increasing interest in advanced cancers. The USA and Italy have made significant contributions to publication quantity and quality. In-depth publishing metrics show the *European Urology* is the most influential journal in the area. We examined main PCa with MetS research orientations and trends using keywords. Nations and

regions must collaborate across borders. Future research should concentrate on broad, high-quality investigations on inflammation and PCa and MetS hormones to improve treatment therapies and help more patients.

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